is often bewildered by the appearance of inscriptions which would revolutionize the whole relations of a given site, if one could only be sure that they did not come from structures in quite a different locality. Other difficulties—which Prof. Van Millingen does not mention—are the suspicious nature of the authorities, who often hinder investigation through fear that the student is a seeker after hidden treasure revealed to him by his knowledge of ancient literature, and such physical hindrances as the great earthquake just alluded to on p. 150, when the author and his photographer were in the dark profundities of one of the ancient subterranean structures of the city wall at the time of the greatest earthquake experienced in Constantinople in two hundred years. There was no exit save by a passage thirty feet long, through which one had to wriggle on his stomach as best he could. In that noisome place those archæologists had to endure the full force of succeeding shocks, with all the noises of grinding walls and falling towers; noises magnified by the conducting power of the great mass of masonry over their heads. And when they did safely emerge into the light of day it was to see the whole atmosphere red with the dust of fallen ruins and to learn that hundreds of people had been killed in the city during those few terrible seconds.

This book is an archæological manual. But this does not signify that it is only this. Its identifications of sites give opportunity, which is admirably utilized, for interesting and readable memoranda upon the Byzantine court and its historical personages and their customs and relations. A set of maps and plans unique in their accuracy of detail, and a fine set of views of important parts of these old walls of Constantinople, add greatly to the value of the book to the student and the general reader.

H. O. D.

Morphologie des Tiën-schan, von Dr. Max Friederichsen. Mit einer Originalkarte. Sonder-Abdruck aus der Zeitschrift der Gesellschaft für Erdkunde zu Berlin, Band XXXIV, 1899.

This interesting monograph gives a comprehensive account of one of the great mountain systems of Central Asia. The author does not write from personal study of the region, but justifies his attempt on the ground of a rich but unappropriated Russian literature of the subject. The accompanying map is clear, and embodies a great variety of facts concerning the orography and hydrography of the region. Thus we have altitudes, as determined from one to

three times by barometer, also by estimate. We find also the passes, with their altitudes, stream courses, explored and conjectural, and the high snow-fields. Routes of trade are shown, with settlements, areas of blown sand, and tracts below sea-level. Superimposed on this map we have upon transparent paper a chart of the lines of later exploration, from Semenov (1857) to Sven Hedin (1896).

The preface discusses the difficulty of writing modern geographic names. This is partly due to the fact that students of the earth are not familiar with linguistic knowledge. Here the difficulty is special, because the original Turko-Tartar or Chinese word is subject to a double transfer, first by a transcription into Russian sounds and characters, and, second, by bringing over these terms from Russian maps and accounts of travel into English, French and German works.

Our knowledge of the mountains of the interior of Asia is the fruit of researches of the naturalists of the century now closing. Reference is, however, made to the work of Pallas (1777), as introductory to the better results of Klaproth, Humboldt, Ritter, and especially of von Richthofen. The name Tian Shan is of Chinese origin, meaning Heaven's Mountains, and was at first applied only to the eastern Tian Shan of our modern maps, reaching perhaps not farther west than Khan-Tengri. Von Richthofen extended the use of the name, on the basis of common strike lines, over the Alai, Pamir and Hindu Kush. This study, however, does not include these groups, nor the Altai on the northeast, but comprehends the mountain mass lying between these limits, as constituting the proper Tian Shan. The surrounding desert and steppe regions are included so far as is needful for the understanding of the mountain system. Within these limits Dr. Friederichsen gives an analysis of horizontal distribution, of the altitudes and of the hydrographic, geologic, tectonic and climatic relations. The author aims at a morphology of the Tian Shan within the limits of Richthofen's law of scientific geography, as dealing with the surface of the earth itself, independent of its vesture and inhabitants, in a domain peculiarly its own.

A considerable section is occupied with a review of the sources of our knowledge. Here chief credit belongs to the Russians. Others, as the English, have usually only touched the borders of the region, or come up to the foot of the mountains. Russian research has developed with the growing influence of that Empire in China. Particular credit is given to Semenov, and, in language of

peculiar interest to the physiographer of to-day. Originally a zoölogist, he had also a good knowledge of geology, and an *understanding for the dependence of surface form upon inner structure.* Thus his researches in Kara-ton, the Alexander mountains and the Naryn mountain land have real value, and he first recognized the two prevailing trends of the region. The maps are also, of course, chiefly a Russian product. Especial mention is made of the map of the Southern boundary of the Russian Empire, on a scale of 1:1,680,000, prepared under the direction of an officer of the War Department.

The Tian Shan lies between 40° and 46° N. lat. (that of north and middle Italy), and between 68° and 92° long. east from Greenwich. The greatest length of the system is about 1,956 km. (1,216 miles). This is more than twice the length of the Alpine system. Taking the principal trends of the Tian Shan we find some ranges on the northwest border of the system diverging in various measure from an east by west line toward the northwest. In the interior, both in the east and west, the prevailing lines are northeast by southwest. The parallel ranges are more numerous and are wider toward the west, but fewer and narrower on the east. To the converging of these two lines of strike is due the arrangement in gentle curves, concave to the north, which is seen on an inspection of the map.

Much is dependent upon these features. Thus the great rivers occupy longitudinal valleys. In the angle where two trends meet human settlement finds shelter. Through the broadening and diverging on the west, the mountains open themselves to commerce in that direction, while they stand wall-like on the east, as a barrier to trade. Thus these westerly-opening "compartments" have, in the later days, offered easy conquest to the colonizing, conquering spirit of the Russians. About these mountains extends a girdle of desert and steppe. The bases of the mountains inclose deep basins, filled with the deposits of parts of the Tertiary sea, as, for example, in the Aralo-Caspian basin. The surface is mantled and sharp contours are obscured by eolian masses of sand and dust. Thus we have also toward the Altai, the Dzungarian basin, and, on the south, toward Tibet, the Tarim basin. The eastern mountains disappear in the desert Shamo (Gobi), and the western go over into the Aralo-Caspian territory. The oasis border at the foot of the mountains is subject to the curse of this proximity. Step by step the destroying sands threaten the fruitful strips between the mountains and the desert.

The author disclaims any intention of presenting a scientific classification of the different groups of the Tian Shan, and cites the Alps, as showing how difficult this is, even for our best-known mountain systems. The chief feature of the horizontal arrangement has already been stated, viz., a departure from the east by west line, in two directions, though the N. E. by S. W. direction is the prevalent one. Coming to the vertical relations, there appears with great regularity as one advances from north to south a rise of absolute altitudes, with lessening of relative heights of mountains above the included valleys. Along the longitudinal axis the altitudes drop toward the east and toward the west, from the central portions of the system. A series of instructive tables shows the altitudes in metres, whether by barometer or by estimate, with the authority for the same. The largest water body within the field is Lake Balkhash, on the plains northward, at an altitude of 270 m. (886 feet.) The most northerly great range is the Dzungarian Ala-tau with heights of more than 3900 m. (12,850 feet). The snow line on the north slope is at 3050–3200 m. (10,060–10,550 feet). Semenov gives the following view of the zones of this range:

1.—Steppe zone, 160–480 m. (550–1600 feet).

2.—Culture zone, good tillage, 480–1300 m. (1600–4300 feet).

3.—Evergreen trees, 1300–2470 m. (4300–8130 feet).

4.—Alpine meadow zone, 2470–2900 m. (8130–9540 feet). Summer station of nomads.

5.—High Alpine zone, 2900–3640 m. (9540–11,995 feet).

6.—Eternal snow.

South and east of the above we find the Iren-khabirgan range, with great heights, 5000–6000 m. (16,460–19,740 feet); the Ili basin, 600–700 m. (1995–2325 feet); and the great Dzungarian basin, 230–700 m. (780–2325 feet). South of this basin is the Bogdo-ola, 4,000–6,000 m. (13,175–19,740 feet); and directly south of this we come upon the Turfan depression, marking levels of 50–70 m. (190–255 feet) *below sea-level.*

Turning to the west half of the Tian Shan system, we find the summits of the northern ranges having maximum altitudes of 4,200–4,800 m. (13,860–15,825 feet), the passes 1500–3000 m. (4950–9870 feet), or more, while the steppes at the foot of the mountains are 600–800 m. (2000–2650 feet) above sea-level. The grand culmination of the entire system is in its south central portion, the Khan-Tengri, with altitudes of 6000–7200 m. (19740–23700 feet). This is also an important centre of powerful and well-known glaciers.

The valleys now or formerly occupied by lakes range from 1615 m. (5300 feet) (Issyk-kul) and 1850 m. (6070 feet) (Kotchkar Basin) to 2873 m. (9426 feet) (Son-kul) and 3450 m. (11,319 feet) (Chatyr-kul).

The Tarim basin on the south of the Tian Shan is a high and large desert area—a most characteristic feature of Central Asia. A girdle of oasis runs along the watered base of the mountains. Far more favorable is the condition of the Ferghana valley on the west, with its flourishing settlements, and opening down by a gap in the mountains to the Aralo-Caspian depression.

There are two chief types of streams: (1) Those which extend east and west along lines of folding, in longitudinal valleys; (2) streams flowing across these lines, from the mountains down to the steppes and deserts and especially from the higher southerly to the lower northerly parts of the system. The drainage is continental—that is, all goes into inland seas, or disappears by evaporation or by infiltrations into the porous waste slopes bordering the mountains. Most of the great longitudinal streams enter these inland seas or lakes. The watersheds not seldom abandon the higher ranges and follow the lower. Watersheds of the second order, due to headward erosion, often separate two streams flowing in opposite directions in longitudinal valleys. Most of these longitudinal trunk streams are believed to occupy genuine synclinal valleys.

An interesting account is given of deposits in high valleys, believed by Richthofen to be of subaerial origin, but held by Semenov and others to be lake deposits. The author holds the former theory untenable in view of many explicit descriptions of the deposits as stratified, but admits the active cooperation of atmospheric agents.

Many of the transverse valleys are believed to have originated as outlet channels of ancient and elevated lakes. The outlet of Son-kul is cited as a present concrete case, and other probable examples are given. The space allotted to this review does not permit reference to the geological formations or to the interesting chapter on the climate and its effect on the morphology of the region.

A. P. B.